PANEL DISCUSSION: SESSION IV CARE OF THE RADIATION-EXPOSED AND INJURED*

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DR. NORMAN SIMON (The New York Academy of Medicine): Will the panel please say a few words concerning the experiences of severe accidents in nuclear reactors. How many have occurred and where?

DR. LUSHBAUGH: I can give my round numbers. In the Radiation Emergency Assistance Center we keep a registry of all the radiation accidents that we can find that have occurred over the world during the last 30 some odd years since 1945. We have a pretty good handle on how many radiation accidents there were, how many people were involved, required treatment, died, et cetera.

Six hundred people were involved in approximately 100 such accidents, and this is roughly over 35 years. Of the 600 involved, 300 had what we would call significant doses. By a significant dose we mean a total body dose somewhat greater than 25 rads total body radiation; some doses were greater than 600 rads to the skin. In this number there were roughly 225 involved in the Marshallese Islands, so that the number of seriously injured people in radiation accidents is only 100.

Of the people who really required medical care, there were approximately 30. In the United States there were eight deaths during roughly 35 years and in the whole world, 22.

DR. HÜBNER: I would like to make a comment. Not all of these radiation accidents are reactor accidents. There have been only four serious reactor accidents where people have been hurt or killed. The SL-1 accident is one of them. In the Yugoslav accident one person died. Then

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we had the Mole accident in 1965 in Belgium; the man involved in this accident survived. And then we had a serious accident in Gundremmingen near Munich; two people died from third degree burns sustained in a steam pipe explosion. They were contaminated with tritium, but they died within a few days because of the burns. These are four serious reactor accidents that I know of. The reactor near Munich is a power reactor. The SL-1 reactor was a training reactor. The Mole and the Yugoslavian reactor were research reactors. In the Munich accident the cause of death was not radiation exposure, but burns from the steam from the cooling system.

DR. MILTON M. ZARET (Scarsdale, New York): I wonder if there has been any thought given to the secondary nonionizing radiations that are emitted. Has anyone done a study to try to do remote measurements of the radio waves created by the plumes or from the isotopes? Radio waves are given off from most of these substances, and they could be detected at a distance. I just wonder if there has been any thought given, or any actual experimentation done, in looking for the nonionizing radiation signatures that could possibly be measured from a distance.

DR. WALD: What I gather that you are talking about is electromagnetic radiation associated with nuclear radiation.

DR. ZARET: That is correct. It is a byproduct.

MR. ANDREW HULL (Brookhaven National Laboratory): The ionizing radiations are so dominant that whatever other frequencies are part of the emissions from a source of radiation are so minor, both in terms of physical effect and in terms of ability to measure them at any distance, that I can not see that this would be useful information.

In those individuals who have had these single exposures to relatively high doses, which includes a fair number of people exposed in radiation therapy, lenticular opacities have not been a problem.

DR. ZARET: Radiation therapy is not directly microwave radiation.

MR. HULL: I thought you said that microwave radiation was associated with gamma or beta radiation. All I am saying is that the evidence of damage has been conspicuous by its absence.

DR. ZARET: We have not been looking for it, to start with. What I was talking about was a method that may be available to measure the radiation, not the biological effect, because there is a great deal of concern about this.

DR. JOHN B. DEHOFF (Baltimore City Health Department): Have there been any deaths or injuries from accidents involving the transport of nuclear wastes? Is that something we need be worried about?

DR. RICKS: There are some very good statistics from 1970 to the present. During that period there have been on an annual basis about 2½ million shipments of radioactive material, including nuclear waste, in this country. In the same period of time there have been about 100 transportation accidents, all involving radioactive material in Type A packages, a Type A package being the kind that medical-grade radionuclides are shipped in.

In these 100 or so accidents, radioactive material was released into the environment on only five or six occasions. There were no injuries to the general public, to individuals responding on an emergency basis, or to the driver of the vehicle in any of these cases. The last one I know of occurred in Wichita, Kansas, and involved source uranium material. That was about three years ago. The statistics for this type of accident can be found in publications by McClure and Emerson and by A. W. Grella.

MR. ROBERT HORST (Nuclear Regulatory Commission): How useful are prodromal symptoms during a high anxiety situation such as Three Mile Island for diagnosing excessive radiation exposure?

DR. WALD: One important characteristic of the entire symptomatology associated with radiation injury is that none of the symptoms are unique to radiation exposure, so that it requires a combination of findings to draw that diagnostic conclusion. Obviously, the history itself, if it is known, is one of the best clues of all.

But you may recall in the triage chart (Table II in my paper) that the presence of the combination of prodromal symptoms and blood-count derangement within the first 48 hours is the basis for suspecting radiation injury. Neither by itself is sufficient basis because of the nonspecificity of all of these changes, but if similar indications from more than one of these evaluative tests emerge, then you begin to suspect the possibility of radiation injury.

As for the other part of the question, about what was the usefulness of prodromal symptom assessment around Three Mile Island, that is a difficult question since there was no organized clinical assessment, nor was any needed. There was in the Japanese A-bomb experience a clear dose response relationship for the end point of nausea and vomiting that was carefully ascertained by history early in the follow-up studies. The symptom incidence curve faded away at just about 2,000 meters from the burst point of the weapon, which is where the radiation exposure faded away, although other effects, such as the blast wave, continued to greater distances.

So it is useful, but your point is well taken if you suggest that prodromal symptoms are not specific.

DR. HOWARD BROWN (The New York Times): I am Medical Director of *The New York Times*, and I would like to make a few comments and solicit your help. I wear several hats. My function as Medical Director of the *Times* is concerned with the health and safety of the employee population. I do not represent the media per se, although The New York Times Company has expanded its print media base into radio broadcasting and cable television. I am also chairman of the Occupational Medicine Section of the Medical Society of the State of New York and chairman of the Environmental Committee of the American Newspaper Publishers Association. One of our objectives is to disseminate health and safety information to our 1,400 newspaper members.

The Federal Emergency Management Agency has responsibility for developing emergency preparedness plans for disasters. Region II administrators are interested in developing courses for the media to enable it to informatively report on catastrophic events. Your help in assisting the Federal Emergency Management Agency in such courses would be welcome.

Returning to my affiliation with *The New York Times*, I must take exception to statements or innuendos that *The New York Times* has published inaccurate or inflammatory articles pertaining to the nuclear power plant industry or nuclear power plant accidents. I can appreciate the psychological impact on the public who feel threatened by a nuclear power plant incident and who do not get timely and accurate information from responsible officials via the media.

Stuart Diamond from *Newsday* has informed us that since Three Mile Island they have developed scientific reportorial capabilities they did not have before. They have also developed a liasion relationship with the Long Island Lighting Company to insure timely and accurate collection of information. We at the *Times* have developed similiar capabilities, where Matt Wald, who has attended this symposium, and whose byline was shown by Dr. Saenger, has done an excellent job in becoming knowledgeable about nuclear matters and in reporting about the industry. I have no defense for the slides of headlines that Dr. Eisenbud presented except to say they represented headlines of many years ago. Dr. Saenger, when you gave your presentation, you presented a slide showing Matt Wald's presentation, which, if you read it, was very responsive and responsible. Basically, what he was talking about was employment in the nuclear

industry and some of the problems the nuclear industry had. The implication was that they represented journalistic malpractice, which could not be further from the truth.

DR. SAENGER: I would like to say that there are two newspapers that I monitor faithfully. One of them is *The New York Times*, by virtue of the fact that I was coming to this meeting. Since there is all this distressing back and forth about Indian Point and the Shoreham reactor, and since it has been covered so objectively by your newspaper, I do agree that your articles are really quite good.

Now, all of this discussion is very appropriate, because the perception of risk is probably 90% of the difficulty which we have between the scientist or physician on the one hand, who would like to have some settled issues, so we can say finally it is safe or it is not, and the need for the news, as it perceives itself, to give out information immediately.

It has been interesting to me that in Cincinnati, where we have offered several courses on radiation accidents and biological effects of radiation, we have over a period of a couple years invited all of the media, the radio, the television, the newspapers, and the suburban newspapers to our meetings without charging them as we charge members of the medical profession, and no one attends.

When you say that it would be desirable for a group such as ourselves to give a course to instruct editors for news gatherers or producers of television shows and many facets which The New York Times Sales Company covers, it is a proposal that we as physicians and scientists concerned with nuclear energy would offer most eagerly; but the degree of participation by the media is another matter.

DR. BROWN: I have several more points relative to the program format. I think it would have been more helpful to get a presentor from the nuclear power industry. We attempted at a planned state medical symposium to get an occupational physician employed by the nuclear power industry to discuss his experience with us, but the industry would not permit it. They apparently are supersensitive about discussing nuclear power plant industrial problems in public.

My second point on programming concerns the lack of a presentation on basic nuclear physics. If your program goal is education, knowledge of nuclear physics is a prerequisite to understanding the issues presented in this symposium. During Dr. Ricks' presentation on emergency response medical teams, which showed them in respirators and full body suits, I wondered if all of us knew that that outfit would not protect against

gamma radiation. The issue of prophylactic use of potassium iodide was well covered but I did not get a clear picture of what kind of event would produce radioactive iodine that would require potassium iodide prophylaxsis. Would the panel recommend that all rescue workers be given potassium iodide?

Would the panel comment on the medico-legal issue of developing guidelines and procedures for rescue workers and particularly on the issue of not sending women of childbearing age into a radioactive environment?

Concerning radioactive environments, it would also have been helpful if the program covered the various monitoring devices that are available. The geiger-muller counter and the thermoluminescent dosimeter were mentioned, but not in sufficient detail to make one knowledgeable about their uses and limitations. If these devices are not accurate or properly calibrated, should the media have to bring their own devices to protect their employees against excess exposure? This covers a lot of areas for the panel to cover but I hope that I can get a few responses to some of them.

DR. LUSHBAUGH: The panel here was invited to talk about the care of radiation-exposed and injured to a group of professional physicians, not to reporters, and we were here at the invitation of Dr. Simon, whom I shall allow to answer your comments.

DR. SIMON: I want to thank Dr. Brown for his various suggestions concerning this meeting. As I had said in my opening to this meeting, this program is part of continuing work on radiation and its effect on the public by the New York Academy of Medicine. There have been several other programs, none of them as deeply involved as this one. The panel was asked by the program committee, a committee which was comprised of people from government, academia, and physicians. This panel was selected because of its expertise in the subject which we have requested, and which they have handled so elegantly. Fortunately, we have a transcript of this meeting, and Dr. Brown's suggestions will be taken very seriously, and will be considered during the continuing programs of the Academy.

DR. RICKS: Oak Ridge Associated Universities also sponsors a one-week course in public information and nuclear energy called "Nuclear Power and the Energy Crisis."

DR. WALD: The Department of Radiation Health of the Graduate School of Public Health of the University of Pittsburgh has a Master's degree program which can be accomplished in two terms, or about 11 months. We also welcome any applications. We do have professionals from other

fields who want cross-information and education. So we shall welcome any journalists or physicians for that program.

DR. LUSHBAUGH: There are also several private companies, Radiation Management Corporation of Philadelphia, Pennsylvania, and the REM Corporation of Albuquerque, New Mexico, that do this kind of instruction.

DR. SAENGER: The question of women who can potentially become pregnant is a very touchy issue, because women were concerned that simply because they have the potentiality of becoming pregnant, they might be excluded from radiation work. Such a position is regarded as discriminatory. There has been considerable concern about the employment of women as radiation workers, especially in industry. I think there have been one or two lawsuits. There certainly have been a lot of public meetings on this issue.

It has finally resolved itself to the fact that if a woman knows she is pregnant it is her responsibility to inform her employers so that the fetus is not exposed to more than five tenths of a rem during the pregnancy. To send a person with that potentiality, or even the potentiality of becoming pregnant, into a potential accident or emergency situation, I think, is a little bit more than most employers would really care to do.

One brief further word about the use of stable potassium iodide to block uptake of radioactive iodine by the thyroid gland. I think that one reason that one does not get a clear picture about this is that there is considerable disagreement, even within the government itself, as to what the appropriate action is and the question of who is going to distribute it. When and under what circumstances distribution should take place has really been left up to the states and perhaps the utilities.

DR. IVER S. RAVIN (Boston Edison Company): I will make an observation about the women in the child-bearing age working in plants. We have had to face that problem since the beginning of our plants, which coincided with the flowering of the women's liberation movement, and we were approached by a number of women who wanted to work in the plant in various controlled areas where there was a greater or lesser amount of radiation.

In the beginning we decided not to allow women of childbearing age to work in these areas, and were faced with challenges on an affirmative action basis, and had to decide which of the lawsuits we would prefer to have, one based on discrimination or one based on a woman who, coincidentally probably, had a miscarriage or deformed fetus.

We now have a situation where any woman who wants to work in our plant can work wherever she wishes if she is not pregnant. It is her obligation not to get pregnant if she chooses to work in controlled areas and to inform us if she is pregnant so that we can then obey the regulations regarding exposure of pregnant women. We now have made that a burden that the woman must bear. Women can waive their rights as far as pregnancies are concerned, but they cannot, at least in the Commonwealth of Massachusetts, waive the rights of the fetus. We do not know what is going to happen if a deformed fetus is born to a woman who decided to work there.

I have a question for Dr. Wald, who referred in his statement to the use of a number of compounds in removing radionuclides from individuals who have internal contamination; particularly prussian blue, alginates, EDTA, and some other compounds. These are not really approved by the Food and Drug Administration for this use. I know that in NCRP 65 their use is also encouraged and recommended.

What are the legal obligations of the individual physicians in nuclear power plants using these? Do we have to have special permission from the Food and Drug Administration for their use as experimental drugs? Should they be part of the routine decontamination kits at nuclear power plants?

DR. WALD: The group at Oak Ridge Associated Universities is the bearer of Food and Drug Administration approval for some of the agents including the DTPA in various forms. As far as the prussian blue, it is a chemical. It is not a pharmaceutical, and I do not believe there is any regulatory implication to using it because of that. Is that correct?

DR. LUSHBAUGH: It is not quite correct. Under the new Orphan Drug Act it is going to be possible to do now what could not be done before, and that is to bring prussian blue into drug status as an orphan drug under an NDA. I think this also happened with alginates.

DR. WALD: Some of these are over-the-counter medications available to people who have coughs or peptic ulcers, for example, and I am not sure that there would be a problem there. But the Orphan Drug Act was signed in January 1983, and I am not sure of the mechanics or implications of its full implementation yet.

DR. LUSHBAUGH: There is going to be an IND or NDA on prussian blue supported by the Department of Energy

DR. EDWARD ELKIN (New York State Department of Health): I think it is unfortunate that Dr. Brown focussed on some of the areas that the conference did not cover, as opposed to lauding this committee for what

the conference did cover. I found this two days to be probably among the most educational days I have spent in this area.

Nuclear energy has been in the public eye since the atomic bombs in Hiroshima and Nagasaki, and I think that 35 to 40 years is plenty of time for the media which controls the communications in this country and the education of the adult population of this country to have educated people regarding nuclear energy. I think they have done a pretty poor job. They have to sell copy and interest people in buying newspapers and tuning into radio and television and if the subject does not have enough pizazz, they are not interested in looking at it.

DR. BROWN: The media have no primary responsibility for educating the public but it is responsible for informing the public. As we learned from this symposium, a great deal of education is needed, especially in this field, and this symposium will be a first step. I certainly agree that this conference was most valuable and great deal was taught and learned. I hope that the teaching/learning process continues. I evoke some of the words of Stuart Diamond in his response on being attacked as a media representative. Attacking the media is not productive; what is needed is opportunity for a dialogue and a productive exchange of ideas. Hopefully, this can take place in future seminars.